



ENERGY STAR® Program Requirements for TVs, VCRs, TV/VCRs, TV/DVDs, and TV/VCR/DVDs

DRAFT 2 Eligibility Criteria (Version 2.0)

Below is the **DRAFT 2** product specification for ENERGY STAR qualified TVs, VCRs, TV/VCRs, TV/DVDs, and TV/VCR/DVDs (Version 2.0). A product must meet all of the identified criteria to be labeled as ENERGY STAR by its manufacturer.

- 1) Definitions: Below is a brief description of TVs, VCRs, TV/VCRs, TV/DVDs, TV/VCR/DVDs and other terms as relevant to ENERGY STAR.
 - A. Television (TV): A commercially available electronic product consisting of a tuner/receiver and a monitor encased in a single housing. The monitor usually relies upon a cathode-ray tube (CRT), liquid crystal display (LCD), or other display device. The TV is designed to receive and display a television signal broadcast by antenna, satellite, or cable. To qualify, the TV must be capable of being powered from either a wall outlet or a battery unit that is sold with an AC adapter. For purposes of this agreement, this definition includes analog and digital televisions in addition to televisions that require additional power to receive and process signals that contain information and/or data for electronic programming guides. This definition does not include TV/Monitor combination units (products that operate as both a TV and monitor) consisting of a tuner/receiver and a monitor encased in a single housing with a computer input port.
 - B. Videocassette Recorder/Videocassette Player (VCR): An electronic product designed to play and/or record video tape. To qualify, the VCR must be capable of being powered from either a wall outlet or a battery unit that is sold with an AC adapter. For purposes of this agreement, this definition includes analog and digital videocassette recorders/videocassette players.
 - C. TV/VCR Combination Unit: A system in which the TV and VCR are combined into a single unit and which meets all of the following criteria: the VCR is included in the television casing; it is not possible to measure the power requirements of the two components separately without removal of the television casing; and the system is connected to the wall outlet through a single power cable. To qualify, the TV/VCR must be capable of being powered from either a wall outlet or a battery unit that is sold with an AC adapter. For purposes of this agreement, this definition includes analog and digital TV/VCRs.
 - D. TV/DVD Combination Unit: A system in which the TV and DVD are combined into a single unit and which meets all of the following criteria: the DVD is included in the television casing; it is not possible to measure the power requirements of the two components separately without removal of the television casing; and the system is connected to the wall outlet through a single power cable. To qualify, the TV/DVD must be capable of being powered from either a wall outlet or a battery unit that is sold with an AC adapter. For purposes of this agreement, this definition includes analog and digital TV/DVDs.
 - E. TV/VCR/DVD Combination Unit: A system in which the TV, VCR, and DVD are combined into a single unit and which meets all of the following criteria: the VCR and DVD are included in the television casing; it is not possible to measure the power requirements of any of the components separately without removal of the television casing; and the system is connected to the wall outlet through a single power cable. To qualify, the TV/VCR/DVD must be capable of being powered from either a wall outlet or a battery unit that is sold with an AC adapter. For purposes of this agreement, this definition includes analog and digital TV/VCR/DVDs.
 - F. Electronic Programming Guide (EPG): An interactive, onscreen menu of TV listings that

downloads program information (e.g., time, date, description of TV programs, etc.) from the vertical blanking interval of a regular TV signal.

- G. Standby Power / Mode: Standby power use depends on the product being analyzed. At a minimum, standby power includes power used while the product is performing no function. For many products, standby power is the lowest power used while performing at least one function. Standby power use occurs during what is referred to as the standby mode of the product. Specifically, for this specification, standby power is defined as the power being used when the product is connected to a power source, produces neither sound nor picture, does not transmit nor receive program information and/or data (excluding data transmitted to change the unit's condition from "standby mode" to "active mode"), and is waiting to be switched to "on" (active/play mode) by a direct or indirect signal from the consumer, e.g., with the remote control.
 - H. Download Acquisition Mode (DAM): The product is connected to a power source, may be producing sound and/or picture, and is downloading channel listing information according to a defined schedule for use by the electronic programming guide. The power requirement in this mode is typically greater than the power requirement in standby mode and less than that in active mode.
 - I. Active/Play ("On") Mode: The product is connected to a power source, produces sound and/or picture, and/or records or plays a videotape or DVD. The power requirement in this mode is typically greater than the power requirement in standby mode.
 - J. Off Mode: An operating condition where no power is being used and the product has not been disconnected from an external power source. This mode is usually engaged by the consumer via a "hard off switch." This mode (and hard off switch) is usually found outside the US market.
 - K. Disconnect: The product is disconnected from all external power sources.
- 2) Qualifying Products: Any TV, TV with EPG, VCR, TV/VCR, TV/DVD, or TV/VCR/DVD that is marketed to the consumer as such and meets the respective product type definition in Section 1 is eligible for the ENERGY STAR label. This specification does not cover products that operate as both a TV and monitor.
 - 3) Energy-Efficiency Specifications for Qualifying Products: Only those products listed in Section 2 that meet the following criteria may qualify as ENERGY STAR.

Table 1: Energy-Efficiency Criteria for ENERGY STAR Qualified TVs, VCRs, TV/VCRs, TV/DVDs, and TV/VCR/DVDs.		
Product Type	Phase I Standby Mode (7/1/02 – 6/30/05)	Phase II Standby Mode (effective 7/1/05)
TV	Analog: ≤ 1 Watt Digital: ≤ 3 Watts	≤ 1 Watt
VCR	≤ 2 Watts	≤ 1 Watt
TV/VCR, TV/DVD, and TV/VCR/DVD Combinations	≤ 4 Watts	≤ 1 Watt

Table 2: Energy-Efficiency Criteria for ENERGY STAR Qualified TVs with built-in EPG.

Product Type	Standby Mode (effective TBD)	Download Acquisition Mode (effective TBD)
TV w/ built-in EPG	TBD through EPG Industry Working Group	If addressed, TBD through EPG Industry Working Group

- 4) Power Measurement: Manufacturers are required to perform tests and self-certify those product models that meet the ENERGY STAR guidelines. The power requirement shall be measured from the outlet or power supply source to the product under test. The Partner shall measure the average true power (in watts) of the product. When performing measurements to self-certify a product model, the products under test must be in the condition (e.g., configuration and settings) shipped to the customer.
- 5) Test Criteria: To ensure consistency in measuring the power requirements for electronics products, this protocol should be followed. Outlined in Section A are the ambient test conditions that should be respected when performing power measurements. These conditions ensure that outside factors do not affect the test results and that the test results can be reproduced. Sections B and C describe the specifications for testing equipment and the test method, respectively. Section D reviews responsibilities, while Section E covers continuing verification.

A. Test Conditions

General Criteria:

Total Harmonic Distortion (Voltage):	< 3% THD
Ambient Temperature:	22°C ± 4°C

Terminations: External speaker terminals terminated per 3.6.2.2 (IEC 107-1)

Market-Specific Criteria:

Market:	United States	Europe and Australia	Japan
Voltage:	115 V RMS ± 3 V RMS	230 V RMS ± 10 V RMS	100 V RMS ± 5 V RMS & 200 V RMS ± 10 V RMS
Frequency:	60 Hz ± 3 Hz	50 Hz ± 3 Hz	50 Hz ± 3 Hz & 60 Hz ± 3 Hz

Note: Testing needs to be done only at a voltage and frequency in the above range. It is not necessary to test all combinations of high voltage/low frequency, high voltage/high frequency, etc.

B. Test Equipment: Manufacturers should measure and report the true standby power¹ requirements of the product. Doing so necessitates the use of a true power wattmeter. Because there are many wattmeters from which to choose, manufacturers need to exercise care in selecting an appropriate model. The following items should be considered when procuring equipment and performing the test:

1. AC Power Source (with sufficient output current for the test unit that meets the requirement for AC line voltage, frequency stability, and THD).
2. True Power Meter (with sufficient accuracy, resolution, crest factor rating, and bandwidth).
3. Oscilloscope with Current Probe (to monitor AC line current waveform, amplitude, and frequency. Optional but recommended).
4. True RMS Volt Meter (to verify voltage at the input of test unit. Optional if AC source output is sufficiently accurate).
5. Frequency Counter (to verify frequency at the input of test unit. Optional if AC source output is sufficiently accurate).

Crest Factor: Electronics equipment may draw current that is not sinusoidal.² While virtually any watt meter can measure a standard current waveform, it is more difficult to select a watt meter when irregular current waveforms are involved.

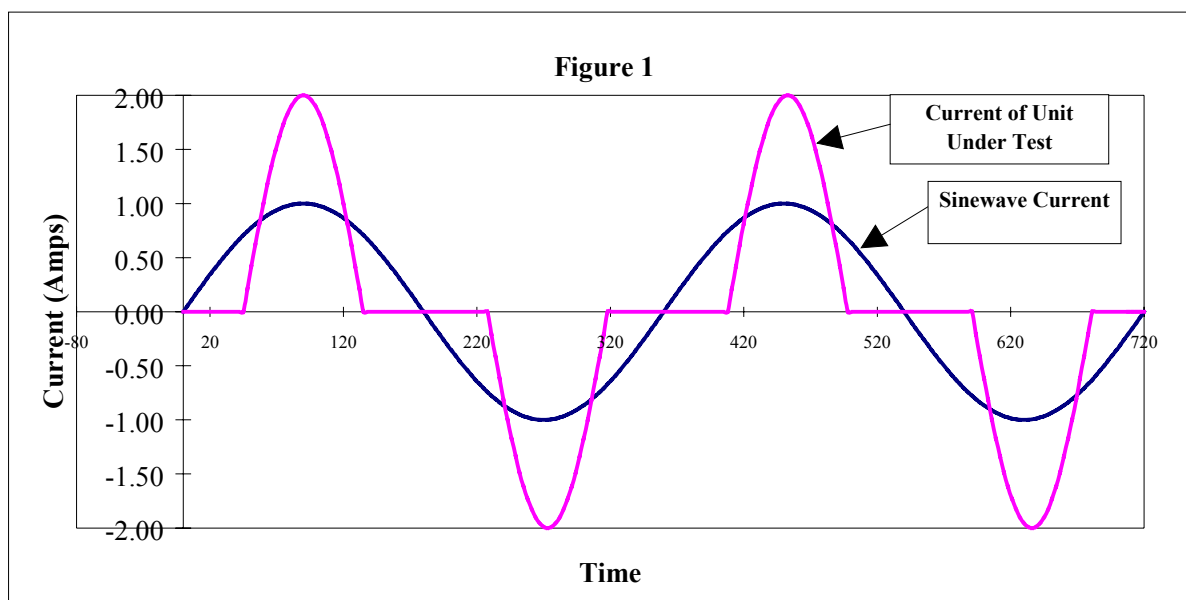
It is critical that the wattmeter selected be capable of reading the current drawn by the product without causing internal peak distortion (i.e., clipping off the top of the current wave). This requires a review of the meter's crest factor rating and the current ranges available on the meter. Better meters will have higher crest factor specifications and more choices of current ranges.

To determine the crest factor rating requirement of the meter and the proper current range settings, the peak current (amps) draw of the product under test in standby mode must first be measured. This can be accomplished using an oscilloscope with a current probe.

A current range on the meter must be selected that is sufficient to register the peak current. Specifically, the full scale value of the current range selected multiplied by the crest factor of the meter (for current) must be greater than the peak current reading from the oscilloscope by at least 15 percent to compensate for any measurement error. (Note: It is difficult to measure within 5 percent using an analog oscilloscope.) For example, if a wattmeter has a crest factor of 4 and the current range is set on 3 amps, the meter can register current spikes of up to 12 amps. If measured peak current is only 6 amps, the meter would be satisfactory. If, however, the current range is set too high, the meter may lose accuracy in measuring non-peak current. Therefore, some delicate balancing is necessary. Make sure that the crest factor is given for the current level that you desire for the meter that you are considering.

¹ True power is defined as (volts)x(amps)x(power factor) and is typically reported as watts. Apparent power is defined as (volts)x(amps) and is usually expressed in terms of VA or volt-amps. The power factor for equipment with switching power supplies is always less than 1.0; therefore, true power is always less than apparent power.

² The crest factor of a current waveform is defined as the ratio of the peak current (amps) to the RMS current (amps). The crest factor for a sinusoidal 60 Hz current waveform is always 1.4. The crest factor for a current waveform associated with a product containing a switching power supply will always be greater than 1.4 (though typically no higher than 8).



Frequency Response: Another issue to consider when selecting a wattmeter is the frequency response rating of the meter. Electronic equipment may cause harmonic waveforms that can lead to inaccuracies in the power measurements. For example, electronics equipment powered by switching power supplies typically produces odd harmonics up to the 21st. To ensure that the harmonics are properly addressed, ENERGY STAR recommends the use of a wattmeter with frequency response of at least 3 kHz. This will account for harmonics up to the 50th, which is recommended by IEC 555.

Resolution: Manufacturers should choose a wattmeter that can provide resolution of 0.1 W.

Accuracy: Catalogues and specification sheets for wattmeters typically provide information on the accuracy of power readings that can be achieved at different range settings. If the power measurement is very close to the energy-efficiency guideline specified in these Program Requirements (Eligibility Criteria), a test procedure with greater accuracy will be necessary. For example, if the ENERGY STAR specification is 1.0 watt or less *and* the resulting accuracy of the wattmeter at the test settings is ± 0.1 watts, then a power measurement of less than 0.9 watts will ensure that the product qualifies for ENERGY STAR.

Calibration: To maintain their accuracy, wattmeters should be calibrated every year with a standard that is traceable to the US National Bureau of Standards (NBS).

C. Test Method: Following are the test steps for measuring the true power requirements of the test unit in standby mode:

1. Power on all test equipment and properly adjust operation range.
2. Connect the test equipment and unit under test.
3. Check for normal operation of the test unit and leave all customer adjustment to factory default settings.
4. Bring the test unit into standby mode (not off mode) either by using the remote control device or by using the ON/OFF switch on the test unit cabinet.
5. Either verify that the wall outlet power is within specifications or adjust the AC power source output as described in Section A (e.g., 115Vrms \pm 3Vrms, 60Hz \pm 3Hz).

6. Set the power meter current range. The full scale value selected multiplied by the crest factor rating (I_{peak}/I_{rms}) of the meter must be greater than the peak current reading from the oscilloscope.
 7. After the unit under test reaches operating temperature and the readings on the power meter stabilize (approximately 90 minutes), take the true power reading in watts from the power meter.
 8. Record the test conditions and test data. The measurement time shall be sufficiently long to measure the correct average value to within a +10% - 0% error. If the device has different standby modes that can be manually selected, the measurement should be taken with the device in the most energy consumptive mode. If the modes are cycled through automatically, the measurement time should be long enough to obtain a true average that includes all modes.
- D. Responsibilities: ENERGY STAR's test criteria are not mandatory, but they will be distributed to outside parties such as buyers and the press. Following the test criteria and producing accurate test results will assist manufacturers in qualifying and labeling products as ENERGY STAR. Companies may determine the appropriate level of stringency and accuracy for their own testing based on their specific products.
- E. Continuing Verification: This testing procedure (protocol) describes the method by which a single unit may be tested and qualify as an ENERGY STAR labeled product. An ongoing testing process is highly recommended to ensure that products from different production runs qualify for ENERGY STAR. A model may qualify as ENERGY STAR if testing indicates that 95 percent of the units sold under this model name/number will meet the specifications contained in these Program Requirements (Eligibility Criteria).
- 6) Effective Date: The date that manufacturers may begin to qualify products as ENERGY STAR will be defined as the *effective date* of the agreement. Any previously executed agreement on the subject of ENERGY STAR labeled TVs, VCRs, and TV/VCRs shall be terminated effective June 30, 2002.
- A. TV, VCR, and Combination Products
1. Phase I: The first phase of this specification, Phase I, shall commence on July 1, 2002 and conclude on June 30, 2005. Upon signing this agreement, the Partner may begin to use the ENERGY STAR logo on product models, packaging, or other product-related materials that meet the Phase I specifications.
 2. Phase II: The second phase of this specification, Phase II, shall commence on July 1, 2005. Specifications for Phase II shall apply to products that the Partner begins to ship after June 30, 2005. However, once an individual product model is qualified by the Partner as ENERGY STAR, the model, packaging, or other product-related materials may continue to bear the ENERGY STAR logo until the model is phased out of the market or until June 30, 2006 (one year after the new specifications take effect), based on whichever comes first.
- B. TVs with Built-in EPGs: The ENERGY STAR TV with built-in EPG specification does not have multiple phases and shall commence on **<date to be determined with industry>**.
- 7) Future Specification Revisions: ENERGY STAR reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions.

In July 2004 (one year prior to the Phase II effective date), ENERGY STAR will begin a review of the Phase II specification (i.e., 1 watt or less). During this evaluation process, ENERGY STAR will assess the market in terms of energy efficiency and new technology. Prior to and during this time frame, industry will have an opportunity to share its data, submit proposals, and voice any concerns. If necessary, the Phase II specification will be revised and reissued so that it recognizes the most energy-efficient models and rewards those manufacturers who have made efforts to further improve efficiency.